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Friedrich Kueffner

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07/13/00

ASSISTANT COMMISSIONER FOR PATENTS
Washington, DC 20231

Date: **July 13, 2000**
Docket No: **HM-345**

Sir:

Transmitted herewith for filing is the patent application of:

Inventor(s): **Axel Weyer, Dirk Letzel, Reiner Külchen and Adolf Zajber**

FOR: **METHOD AND DEVICE FOR CHANGE OF SECTION OF A BILLET OF A CONTINUOUS CASTING PLANT DURING CONTINUOUS CASTING**

ENCLOSED ARE:

(X) Specification (**17** pages), Claims (**6** pages/**11** claims) & Abstract;
(X) **two** (**2**) sheets of Drawings; (Figs. 1 and 2)
(X) Declaration and Power of Attorney; **UNSIGNED**
( ) Assignment to SMS Schloemann-Siemag Aktiengesellschaft;
( ) Certified copy of GermanPat.Appli.No. 199 33 635.0 filed July 17, 1999 the priority of which is claimed under 35 USC 119;
( ) Verified Statement to establish Small Entity Status (37 CFR 1.9 & 1.27);
( ) Information Disclosure Statement, PTO-1449 and ___ references;

THE FILING FEE HAS BEEN CALCULATED AS SHOWN BELOW:

	Claims filed	Extra	SMALL ENTITY	or	LARGE ENTITY
Basic Fee			$ 345.00		$ 690.00
Total Claims	**11**	-20=	x $ 9.=		x $ 18.=
Indep. Claims	**1**	- 3=	x $ 39.=		x $ 78.=
( )Multiple Dependent Claim Presented?			x $130.=		x $260.=

Respectfully submitted

FK:ml

Friedrich Kueffner - Reg. No. 29,482

APPLICATION FOR UNITED STATES LETTERS PATENT

METHOD AND DEVICE FOR CHANGE OF SECTION OF A BILLET OF A CONTINUOUS CASTING PLANT DURING CONTINUOUS CASTING

HM-345

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a method for changing the section of a billet of a continuous casting plant during continuous casting operation wherein opposed sides of the billet are in operative contact with oppositely arranged roll supports positioned below a casting die, wherein the roll supports are divided into sequentially arranged segments that support rolls and are connected to one another by jointed connections, wherein each segment is independently adjustable with regard to an angle relative to the billet, and wherein in an initial position the billet guide to be changed is adjusted to a uniform production format thickness (section of the billet). The invention also relates to a device for performing the method.

2. Description of the Related Art

The change of section of a billet in continuous casting plants during the continuous casting operation is an absolute requirement for optimizing production. However, in the past it was necessary to reduce the casting speed for a period of time for the purpose of thickness (section)

reduction or thickness (section) increase. This results in production losses, and the entire course of the production is at least momentarily thrown off balance. Moreover, in the currently practiced methods it is only possible to perform a fixedly adjusted, stepped change of section.

The patent document EP 0 450 391 B1 discloses a device for supporting a metal billet, especially for soft reduction, in a strip casting plant wherein below the continuous casting die on both sides of the billet mirror-symmetrically and oppositely arranged roll supports are provided whose rolls are in operative contact with the billet. Each roll support is arranged on a stationary frame and divided into several roll-supporting segments which are connected to adjusting devices. The roll-supporting segments are connected with articulation to one another such that each segment can be independently adjusted at any desired angle relative to the billet and fixed in this position, wherein the upper adjusting device is used for the general adjustment of the roll support. This adjusting device can be a mechanical, a hydraulic or a mechanic-hydraulic adjusting device.

The patent document DE 43 38 805 C2 discloses a method and a device for operating a continuous casting plant,

especially for cast-on of a continuous casting plant for producing thin slabs for hot strip rolling, with at least one reduction roll pair arranged downstream of the continuous casting die. Moveable thin slab guiding elements are positioned downstream of the reduction roll pair. The reduction roll pair is adjusted, after a predetermined length of the hot strip has passed through, to a smaller gap width which results in squeezing off of the liquid phase. The hot strip is shaped to a cast-on format having a thickness which is less than the thickness of the desired final format. The strip guiding elements, respectively, the reduction roll pair, are subsequently, preferably successively, adjusted to the thickness of the final format as soon as the cast-on format of reduced thickness is completely positioned within their adjusting area. The reduction roll pair is pressure-controlled and is positioned in accordance with the final format after the strip guiding elements have been advanced.

The patent document EP 0 743 116 A1 discloses a vertical casting production line for billets, comprising a casting die as well as a component group with foot rolls downstream of the exit of the casting die, moreover a plurality of guiding units, a correlated vertical roll segment as well as a driver arrangement in connection with a

horizontal segment of the casting production line. The guiding units comprise at least the entire vertical segment of the casting production line wherein at least a portion of the rolls of the guiding elements cooperate with adjusting devices which are controlled by a process data unit in order to ensure a controllable soft reduction at least in the second part of the vertical segments.

The patent document DE 196 39 297 A1 discloses a method and a device for high-speed continuous casting plants with a billet thickness reduction during solidification. In the method and the corresponding device for continuous casting of billets whose cross-section is reduced during the solidification, wherein casting is preferably performed with an oscillating casting die, the billet cross-section is reduced linearly along a minimal length of the billet guide directly below the casting die. By means of the subsequent further billet cross-section reduction along the remaining billet guide, the so-called soft reduction, up to a point maximally directly before the final solidification or the liquid phase tip, a critical deformation of the billet can be prevented by taking into consideration the casting speed as well as the steel quality.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a method as well as a device suitable for performing the method for format thickness change (change of section) of the billet of a continuous casting plant during continuous casting, in which the casting speed for the transitional process to the change of section is not reduced, i.e., constant production and casting conditions are maintained. The transitional length of the billet during the change a section is to be shortened for the purpose of avoiding production losses. In all transitional situations of the change of section an optimal billet support is to be ensured for reducing break-out risks.

In accordance with the present invention, this is achieved in that the change of section is carried out in a controlled sequence of adjusting steps of the segments, in particular, in that

- a sequential advancement of the sequentially arranged segments at their jointed connections in the casting direction is performed for reducing the format thickness or section, and
- a sequential moving away of the sequentially arranged segments at their jointed connections in the casting

direction is performed for increasing the format thickness or section.

With the disclosed course of the method for a change of section for continuous casting plants the following is achieved:

- the casting speed is not reduced for the transition so that an increase of the production output in comparison to the prior art as well as constant production and casting conditions result;
- the transition length of the billet to be produced is shortened so that production losses are reduced;
- the thickness or section changes can be performed with continuously selectable values in a wide adjusting range as a function of the production program and this results in a high flexibility of the plant;
- for a reduced material thickness with continuously reduced wedge shape the roll skirt provides a sufficient billet support wherein the exit side is readjusted according to the material thickness, while for format thickness increase it is achieved that with increased material thickness as a result of the increasing wedge shape the roll skirt provides a sufficient support for the billet and the exit side is readjusted according to the material thickness.

In a further embodiment of the method it is suggested that for a format thickness reduction with constant casting speed, wherein the solidification point of the billet 9 is, for example, in the segment n = 3 , the exit side of the first segment n = 1 is advanced via the jointed connection with the inlet side of the segment n = 2 by set-point control in a first adjusting phase, and, after reaching the target position, i.e., the segment position for the target format, the exit side of the segment n = 2 is advanced together with the inlet side of the segment n = 3 in a second adjusting phase, and in a sequence of identical steps the adjustments of the segments n = 3, 4 to i to the target position is carried out.

According to another embodiment of the invention, it is proposed that for a format thickness increase at constant casting speed, wherein the liquid phase tip of the billet is, for example, located in the segment n = 3, first the exit side of the segment n = 1 is moved away at the jointed connection together with the inlet side of the segment n = 2 by set-point control in a first adjusting phase, and, after reaching the target position, i.e., the segment position for the target format, the exit side of the segment n = 2 together with the inlet side of the segment n = 3 is moved away in a second adjusting phase, and in a sequence of

identical steps the adjustment of the segments n = 3, 4 to i to the target position is carried out.

According to a further embodiment of the method of the invention, it is proposed that the advancing of the segments is carried out with constant speed by dynamic position control, wherein a predetermined force threshold value is not surpassed.

Moreover, it is suggested according to the invention to calculate the adjusting speed of the segments by taking into consideration the permissible billet elongation limit and the current casting speed in connection with the current format adjustment, respectively, according to the resulting volume flow of the billet. Advantageously, the adjusting speed is calculated via the current casting speed, the segment length, and the required adjusting stroke according to the equation

$$V = Ds/Ls * Vcast$$

wherein Ds is the format thickness change (change of section), Ls is the segment length, and Vcast is the current casting speed.

Further developments of the method propose that the adjusting process is monitored, for example, by the current

cylinder pressures of hydraulic adjusting devices and, when a threshold value is surpassed, the method switches from position control to force control and, after reaching the target position, switches back to position control.

Finally, it is suggested that the respective adjusting speeds of the exit side and the inlet side of adjoining segments are inevitably synchronous due to the jointed connection of the exit side of the segment with the inlet side of the adjoining segment.

In a device for format thickness change of the billet of a continuous casting plant, wherein opposed sides of the billet are in operative contact with oppositely arranged roll supports below the casting die, wherein the roll supports are divided into sequentially arranged segments that support rolls and are connected to one another by jointed connections, and wherein each segment is independently adjustable with regard to an angle relative to the billet, the adjusting devices are advantageously provided with means for position or force control. Expediently, the segments are in cooperative connection with controlled and direction-reversing hydraulic cylinders in the area of their jointed connections between the exit side and the inlet side.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

Fig. 1 shows the sequence of adjusting steps of the method according to the invention, illustrated in sequential phases, for format thickness reduction; and

Fig. 2 shows the sequence of adjusting steps of the method according to the invention, illustrated in sequential phases, for format thickness increase.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 shows the individual method steps of the method according to the invention for a format thickness reduction of the billet 9 of a continuous casting plant in continuous casting operation. Below the casting die 10 the billet 9 is in operative contact on both opposite sides with mirror-symmetrically arranged roll supports 8, 8' which are divided into sequentially arranged roll-supporting segments 1 through 4 connected to one another by jointed connections 5 through 7. Each segment 1 through 4 is adjustable independently with respect to its angled position relative to the billet 9. In an initial position the entire billet guide comprised of the roll supports is adjusted to a uniform production format thickness as illustrated in the initial position (to the left in Fig. 1). The format thickness change (change of section) is performed in a controlled sequence of adjusting steps of the segments 1 through 4. The format thickness reduction is carried out by sequentially advancing the sequentially arranged segments 1 through 4 in the casting direction; this is illustrated by the phases 1 through 4 of Fig. 1. Beginning with the exit side of the segment 1 the jointed connection 5, together with inlet side of segment 2, is advanced by set-point control.

After reaching the target position, i.e., the segment position for the target section, the exit side of the segment 2 and the inlet side of the segment 3 are advanced in a second adjusting step, and in a sequence of identical steps the adjustment of the segments 3 and 4 is performed according to the illustrated phases 3 and 4. For this purpose, force-applying means 11 act on the jointed connection 5 in the direction of reducing the billet 9, followed in the phase 2 by the action of the adjusting device 12 in the direction of reducing the billet cross-section, and further sequentially in phase 3 and phase 4 by the action of the adjusting devices 13 and 14 until a continuous overall reduced format thickness is reached according to the final state of phase 4.

Based on the illustration of the course of the method for a format thickness reduction illustrated in Fig. 1, in the initial position present before the phase 1 the entire billet guide (roll supports) is adjusted to a production thickness X during the casting operation. The casting speed is constant; the liquid phase tip (solidification point) is within the segment 3.

For starting the thickness reduction according to phase 1, as has been mentioned before, the exit side of the

segment 1 and the inlet side of the segment 2 are advanced with constant speed by dynamic position control by means of set-point control. A predetermined force threshold value is not surpassed. The advancing speed is calculated taking into consideration the permissible billet elongation limit and the current casting speed in connection with the current format adjustment, respectively, according to the thus resulting volume flow of the billet.

The adjusting speed to be maintained is calculated based on the current casting speed, the segment length, and the required adjusting stroke according to the equation

$$V = Ds/Ls * Vcast$$

wherein Ds is the format thickness change, Ls is the segment length, and Vcast is the current casting speed.

An effective force monitoring action, computable, for example, via the current cylinder pressures of a hydraulic adjusting device, monitors the adjusting process. Should the force surpass a calculated threshold value or limit, the method switches from position control to force control. After reaching the target position, the method switches back to position control.

With the described course of the method, it is achieved

that with reduced material thickness of the wedge shape passing through the roll skirt provides a sufficient support of the billet 9 and that the exit side is re-adjusted according to the material thickness.

The liquid phase present within the segment 1, 2 and optionally 3 is not interrupted by the process. Proper support for the billet is provided in all phases by switching from position control to force control.

In the following, the format thickness increase according to the representation of the method steps in Fig. 2 will be described.

First, in the initial position before the phase 1 the entire billet guide is adjusted to production thickness X in the casting operation. The casting speed is constant, the liquid phase tip (solidification point) is positioned in the segment 3. The thickness increase is started in phase 1.

As soon as the target format of the exit side of the segment 1 and of the inlet side of the segment 2 at the end of the phase 1 has been reached, the exit side of the segment 2 is moved away, i.e., the gap is widened (phase 2).

The adjusting speed is calculated based on the current casting speed, the segment length, and the required adjusting stroke in the same way as disclosed in connection with the format thickness reduction.

An effective force monitoring action, calculated by means of the current cylinder pressures of hydraulic adjusting devices, permanently controls the adjusting process.

Should the force of the calculated threshold value or limit be surpassed, the method switches from position control to force control. After reaching the target position, the method switches back to position control.

With the described course of the method, it is achieved that the roll skirt provides a sufficient support action for the billet 9 for increased material thickness with continuously increasing wedge shape and that the exit side is accordingly re-adjusted to the material thickness.

Subsequently, the inlet side of the segment 3 is moved away simultaneously with the exit side of the segment 2 at the same adjusting speed, as illustrated in phase 2 of Fig. 2, for widening the gap. The monitoring function is carried

out in analogy to that of the exit side of segment 2.

As soon as the target format of the inlet side of the segment 3 has been reached, the exit side of the segment 3 and the inlet side of the segment 4 (phase 3) are moved away from the billet (gap is widened). The calculation of the casting speed and the monitoring action are carried out as disclosed above.

As soon as the target format of the inlet side of segment 4 has been reached, the exit side of segment 4 (phase 4) is moved away from the billet. The calculation for the monitoring action is carried out as disclosed above.

While specific embodiments of the invention have been shown and described in detail to illustrate the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. A method for changing the section of a billet of a continuous casting plant during continuous casting, wherein opposed sides of the billet are in contact with oppositely positioned roll supports arranged below a continuous casting die, wherein the roll supports are comprised of segments having rolls, wherein adjoining ones of the segments of each roll support are connected to one another by a jointed connection and wherein each segment is configured to be adjustable independent of the other segments with respect to an angular position relative to the billet, and wherein in an initial position of the segments of the roll supports are adjusted to a uniform billet section; the method comprising the step of:

advancing sequentially in a direction of continuous casting the segments toward the billet by moving the jointed connections toward the billet in a controlled sequence of adjusting steps for reducing the section of the billet; or

moving sequentially in a direction of continuous casting the segments away from the billet by moving the jointed connections away from the billet in a controlled sequence of adjusting steps for increasing the section of the billet.

2. The method according to claim 1, wherein, for reducing the section of the billet with a constant casting speed and with the solidification point of the billet having passed the first and second segments, an exit side of the first segment and an inlet side of the second segment in the casting direction are advanced in a first one of the adjusting steps toward the billet by moving the first and second segments at the jointed connection connecting the first and second segments toward the billet by set-point control, and after the first and second segments have reached a target position, an exit side of the second segment and an inlet side of the third segment in the casting direction are advanced in a second one of the adjusting steps toward the billet by moving the second and third segments at the jointed connection connecting the second and third segments toward the billet, and after the second and third segments have reached a target position, in further ones of the adjusting steps the third and further segments are advanced toward the billet sequentially in the same manner until all segments have reached the target position.

3. The method according to claim 1, wherein, for increasing the section of the billet with a constant casting speed and with the solidification point of the billet having

passed the first and second segments, the exit side of the first segment and the inlet side of the second segment in the casting direction are moved away from the billet in a first one of the adjusting steps by moving the first and second segments at the jointed connection connecting the first and second segments away from the billet by set-point control, and, after the first and second segments have reached a target position, the exit side of the second segment and the inlet side of the third segment in the casting direction are moved away from the billet in a second one of the adjusting steps by moving the second and third segments at the jointed connection connecting the second and third segments away from the billet, and, after the second and third segments have reached a target position, in further ones of the adjusting steps the third and further segments and so forth are moved away from the billet sequentially in the same manner until all segments have reached the target position.

4. The method according to claim 1, wherein the segments are adjusted at a constant adjusting speed with dynamic position control, wherein a predetermined force threshold value is not surpassed.

5. The method according to claim 1, further

comprising the step of calculating an adjusting speed of the segments for advancing or moving away the segments based on permissible billet elongation limit, the current casting speed, the current section adjustment, and the resulting volume flow of the billet.

6. The method according to claim 5, wherein the adjusting speed is calculated, based on the current casting speed, the segment length, and the required adjusting stroke of the segments, by the equation

$$V = Ds/Ls * Vcast$$

wherein Ds is the section change, Ls is the segment length, and Vcast is the current casting speed.

7. The method according to claim 1, wherein the adjusting steps are carried out by hydraulic adjusting devices, further comprising the step of monitoring the adjusting steps via current cylinder pressure of the hydraulic adjusting devices, wherein, when a predetermined force threshold value is surpassed, force control is applied instead of position control and wherein, when the target position has been reached, the position control is applied again.

8. The method according to claim 1, wherein, because

of the jointed connections, the adjusting speed of an exit side of one of the segments and the adjusting speed of an inlet side of an adjoining one of the segments in the casting direction are synchronous.

9. The method according to claim 1, wherein the adjusting steps are hydraulically controlled and wherein the adjusting steps begin at an exit side of the first segment in the casting direction and are sequentially continued simultaneously at an inlet side and an exit side of the sequential segments.

10. A device for performing the method according to claim 1, the device comprising:

a first roll support and a second roll support positioned opposite one another and configured to receive a billet therebetween;

the first and second roll supports comprised of segments having rolls, wherein adjoining ones of the segments of each roll support are connected to one another by a jointed connection and wherein each one of the segments is configured to be adjustable independent of the other segments with respect to an angular position relative to the billet;

an adjusting device configured to move the

segments of the first and second roll supports, wherein the adjusting devices comprises means for position control or force control.

11. The device according to claim 10, wherein the adjusting device comprises controlled, direction-reversing hydraulic cylinders configured to act on the segments in the area of the jointed connections, wherein the first segment has an inlet side and an exit side and has only one of the hydraulic cylinders correlated therewith in the area of the exit side.

ABSTRACT OF THE DISCLOSURE

In a method for changing the section of a billet of a continuous casting plant during continuous casting, wherein opposed sides of the billet are in contact with oppositely positioned roll supports arranged below a continuous casting die, wherein the roll supports are comprised of segments having rolls, wherein adjoining ones of the segments of each roll support are connected to one another by a jointed connection and wherein each segment is configured to be adjustable independent of the other segments with respect to an angular position relative to the billet, and wherein in an initial position the segments of the roll supports are adjusted to a uniform billet section, a thickness reduction can be achieved by advancing sequentially in a direction of continuous casting the segments toward the billet by moving the jointed connections toward the billet in a controlled sequence of adjusting steps or a thickness increase can be achieved by moving sequentially in a direction of continuous casting the segments away from the billet by moving the jointed connections away from the billet in a controlled sequence of adjusting steps.

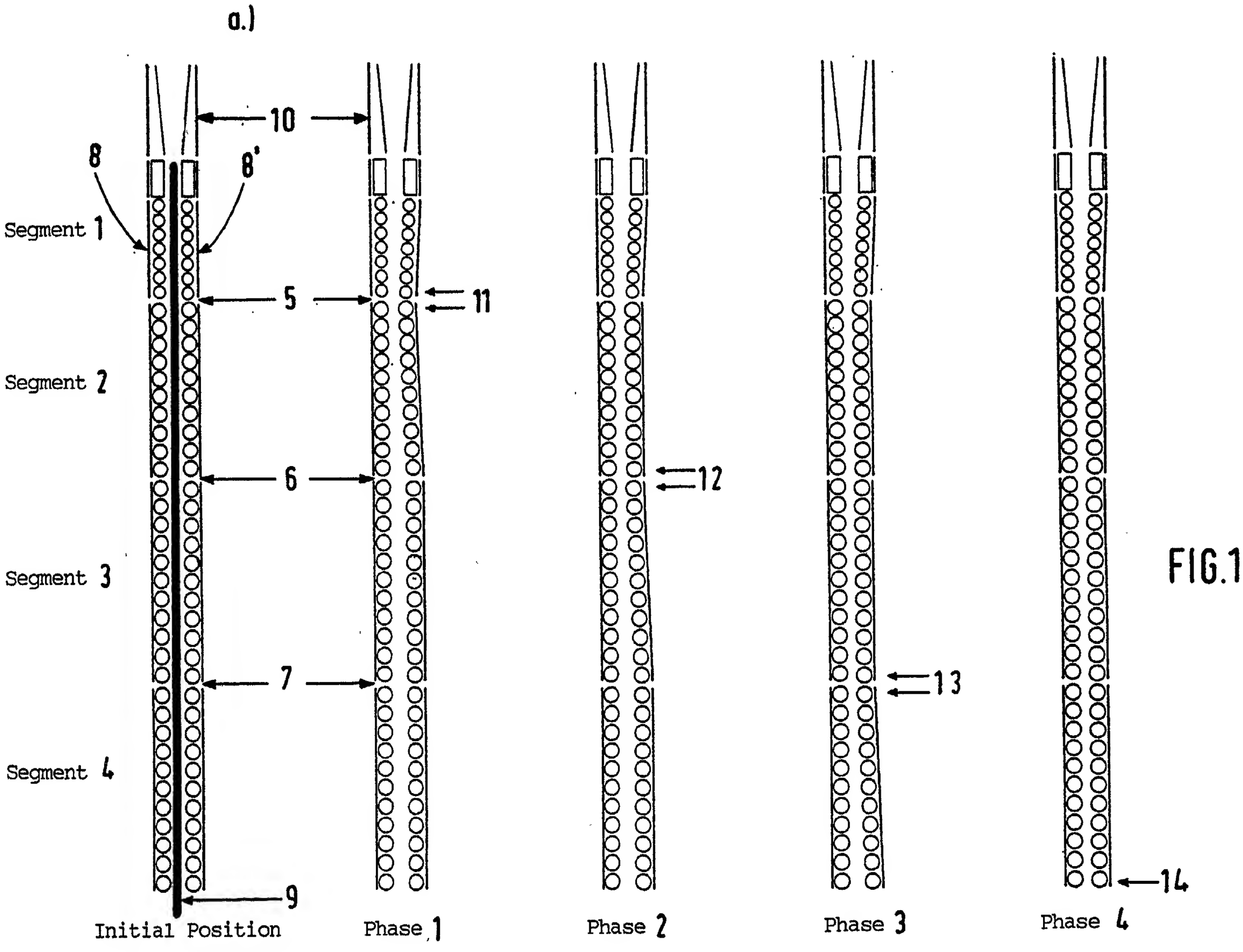
a.)
10
8
8'
Segment 1
5
11
Segment 2
6
12
Segment 3
7
13
Segment 4
9
14
Initial Position
Phase 1
Phase 2
Phase 3
Phase 4

FIG.1

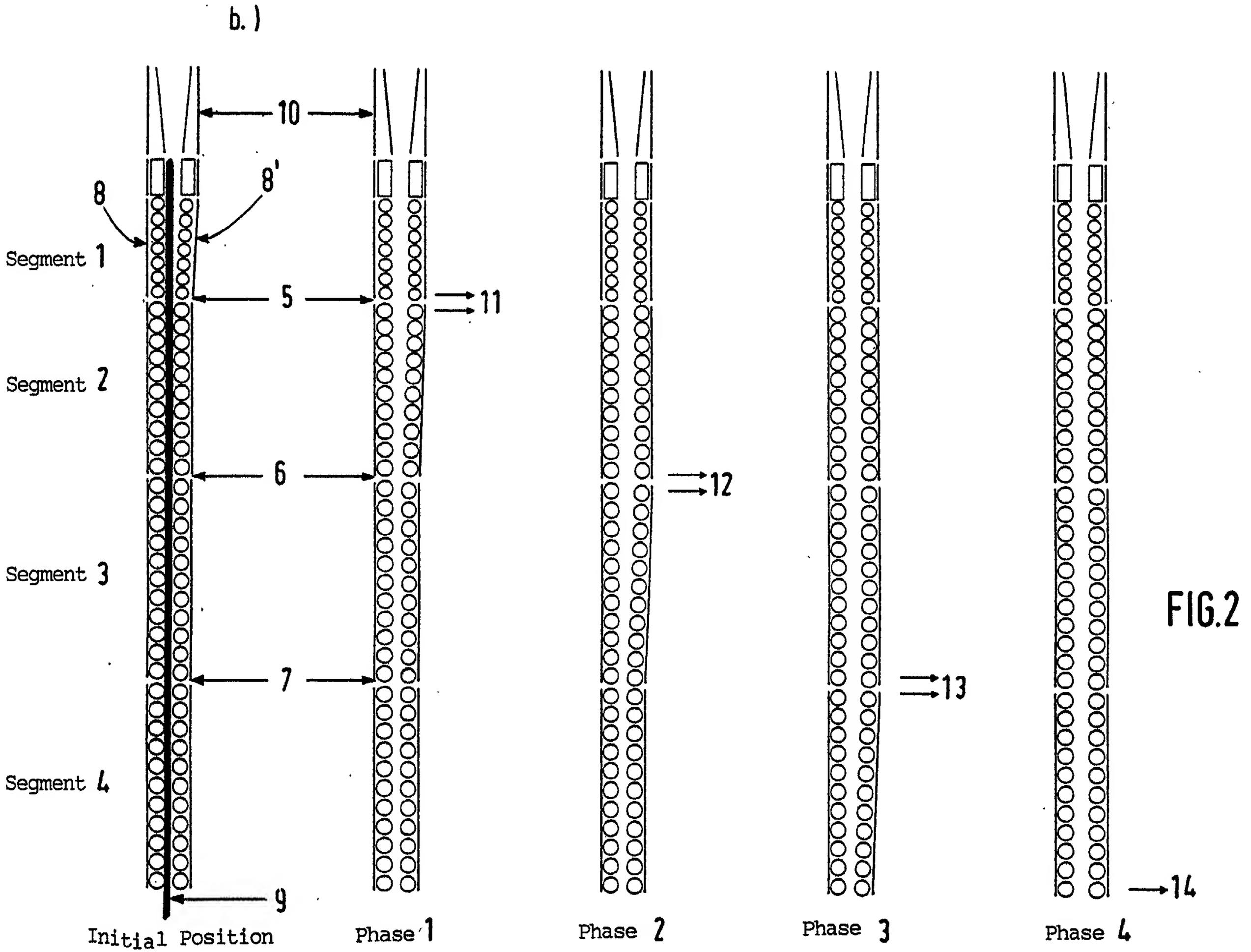
b.)
10
8
8'
Segment 1
5
11
Segment 2
6
12
Segment 3
7
13
Segment 4
9
14
Initial Position
Phase 1
Phase 2
Phase 3
Phase 4

FIG.2

Docket No.: HM-345

Declaration and Power of Attorney for Patent Application
Erklärung für Patentanmeldungen mit Vollmacht
German Language Declaration

Als nachstehend benamter Erfinder erkläre ich hiermit an Eides Statt:

As a below named inventor, I hereby declare that:

daß mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

My residence, post office address and citizenship are stated below next to my name.

daß ich, nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird and für den ein Patent beantragt wird für die Erfindung mit dem Titel:

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

VERFAHREN UND VORRICHTUNG ZUR FORMATDICKENÄNDERUNG DES GUßSTRANGES EINER STRANGGIEßANLAGE IM KONTINUIERLICHEN GIEßBETRIEB

METHOD AND DEVICE FOR CHANGE OF SECTION OF A BILLET OF A CONTINUOUS CASTING PLANT DURING CONTINUOUS CASTING

deren Beschreibung
(Zutreffendes ankreuzen)

the specification of which (check one)

[X] hier beigefügt ist.

[X] is attached hereto

[ ] am _____ unter der Anmeldungsseriennummer _____ eingereicht wurde und am _____ abgeändert wurde (falls tatsächlich abgeändert).

[ ] was filed on Application Serial No. _____ and was amended on _____ (if applicable)

Ich bestätige hiermit, daß ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell duch einen Zusatzantrag, wie oben erwähnt, abgeändert wurde.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Patentierbarkeit in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) von Wichtigkeit sind, an.

I acknowledge the duty to disclose information which is material to patentability in accordance with Title 37, Code of Federal Regulations, §1.56(a).

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent order eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder ein Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

Docket No. HM-345

Erklärung mit Vollmacht (auf Deutsch) **Declaration and Power of Attorney (in English)**

199 33 635.0	Germany/Deutschland	July 17, 1999/17. Juli 1999	X	
(Number) (Nummer)	(Country) (Land)	(Day/Month/Year Filed) (Tag/Monat/Jahr eingereicht)	Yes Ja	No Nein
(Number) (Nummer)	(Country) (Land)	(Day/Month/Year Filed) (Tag/Monat/Jahr eingereicht)	Yes Ja	No Nein
(Number) (Nummer)	(Country) (Land)	(Day/Month/Year Filed) (Tag/Monat/Jahr eingereicht)	Yes Ja	No Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Pargraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 112, offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder internationalen Anmeldedatum dieser Anmeldung bekannt sind.

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or international filing date of this application.

(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status/ patentiert anhangig, aufgegeben)	(Status/ patented, pending, abandoned)
(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status/ patentiert anhangig, aufgegeben)	(Status/ patented, pending, abandoned)

Ich erkläre hiermit, daß alle von mir in der vorliegenden Erklärung gemachten Angaben nach meinem besten Wissen und Gewissen der vollen Wahrheit entsprechen, und daß ich diese eidesstattliche Erklärung in Kenntnis dessen abgebe, daß wissentlich und vorsätzlich falsche Angaben gemäss Paragraph 1001, Absatz 18 der Zivilprozessordnung der Vereinigten Staaten von Amerika mit Geldstrafe belegt und/oder Gefängnis bestraft werden können, und daß derartig wissentlich und vorsätzlich falsche Angaben die Gültigkeit der vorliegenden Patentanmeldung oder eines darauf erteilten Patentes gefährden können.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Docket No. HM-345

Erklärung mit Vollmacht (auf Deutsch)

VERTRETUNGSVOLLMACHT: Als benannter Erfinder beauftrage ich hiermit den nachstehend benannten Patentanwalt (oder die nachstehend benannten Patentanwälte) und/oder Patent-Agenten mit der Verfolgung der vorliegenden Patentanmeldung sowie mit der Abwicklung aller damit verbundenen Geschäft vor dem Patent-und Warenzeichenamt:

FRIEDRICH KUEFFNER, Reg. No. 29,482

Declaration and Power of Attorney (in English)

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

FRIEDRICH KUEFFNER, Reg. No. 29,482

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Voller Name des einzigen oder ursprünglichen Erfinders:	Full name of first or sole inventor:
Axel Weyer	**Axel Weyer**
Unterschrift des Erfinders — Datum	Inventor's Signature — Date
Wuppertal, Deutschland Wohnsitz	Wuppertal, Germany Residence
Deutsch Staatsangehörigkeit	German Citizenship
Rauhaus Feld 27 42349 Wuppertal, Deutschland Postanschrift	Rauhaus Feld 27 42349 Wuppertal, Germany Post Office Address

Docket No. HM-345

Erklärung mit Vollmacht (auf Deutsch) **Declaration and Power of Attorney (in English)**

Voller Name des zweiten Miterfinders: **Dirk Letzel** Unterschrift des Erfinders Datum Ratingen, Deutschland Wohnsitz Deutsch Staatsangehörigkeit Plättchesheide 5 40878 Ratingen, Deutschland Postanschrift	Full name of second joint inventor: **Dirk Letzel** Inventor's Signature Date Ratingen, Germany Residence German Citizenship Plättchesheide 5 40878 Ratingen, Germany Post Office Address
Voller Name des dritten Miterfinders: **Reiner Külchen** Unterschrift des Erfinders Datum Krefeld, Deutschland Wohnsitz Deutsch Staatsangehörigkeit Rembertstraße 92 47809 Krefeld, Deutschland Postanschrift	Full name of third joint inventor: **Reiner Külchen** Inventor's Signature Date Krefeld, Germany Residence German Citizenship Rembertstrasse 92 47809 Krefeld, Germany Post Office Address

Docket No. HM-345

Erklärung mit Vollmacht (auf Deutsch) **Declaration and Power of Attorney (in English)**

Voller Name des vierten Miterfinders: **Adolf Zajber**	Full name of fourth joint inventor: **Adolf Zajber**
Unterschrift des Erfinders Datum	Inventor's Signature Date
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